PROGRAM facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Power Systems Advanced Research

04/2004

COAL UTILIZATION SCIENCE PROGRAM

Goal

The goal of the Coal Utilization Science Program (CUS) is to conduct research that supports the development of technologies for clean, efficient electric power generation in the areas of efficiency, reliability, and environmental performance improvements. The Program emphasizes experimental research and theoretical investigations to produce fundamental information on processes and mechanisms.

Description

CUS is a scientifically oriented, crosscutting R&D program designed to develop the tools necessary to improve the efficiency and environmental performance of advanced power systems. This is accomplished by developing a basic understanding of the underlying chemical and physical processes that form specific technical problems.

The Program often serves as a bridge between basic science and technology, using state-of-the-art methods to perform theoretical investigations, generate high-quality data, examine critical mechanisms, and explore novel concepts. The CUS Program contracts with businesses, universities, and national laboratories. Often, multi-laboratory teams participate in both formal and informal teaming arrangements. The generic and noncommercial nature of the research has enabled international collaboration with the IEA Coal Combustion Science Annex to extend limited R&D budgets.

Challenges

The challenge for fossil fuel power systems like Advanced Research Technologies, including the CUS Program, is to produce technologies that are built to specific performance applications:

- Utilizes our abundant resources;
- Functions efficiently and reliably in hostile operating conditions;
- Addresses economic constraints of advanced industrial applications; and
- Meets public demands for a cleaner environment and lower consumer cost.

Fossil fuel power systems must become cleaner while maintaining economic competitiveness in a deregulated power industry. FutureGen, a prototype power plant project, is an example of a technology that can meet these challenges. A $1 billion dollar initiative, FutureGen is to become the world's first coal-based, zero-emission power plant to produce electricity and hydrogen. Technologies are being produced within the CUS Program that will enable FutureGen to become a reality.

CONTACT POINTS

Robert Romanosky
Technology Manager
Power Systems – Advanced Research
304-285-4721
robert.romanosky@netl.doe.gov

Susan Maley
Project Manager
Coal Utilization Science
304-285-1321
susan.maley@netl.doe.gov

CUSTOMER SERVICE NUMBER

1-800-553-7681

WEBSITE

www.netl.doe.gov

PARTNERS

Albany Research Center
Albany, Oregon

Ames National Laboratory
Ames, Iowa

Argonne National Lab
Arizona State University
Tempe, Arizona

California Institute of Technology
Pasadena, CA

Carnegie Mellon University
Pittsburgh, Pennsylvania

Foster Miller, Inc.
Waltham, MA

Fluent, Inc.
Morgantown, WV

FluoreScience, Inc.
Oak Ridge, Tennessee

Iowa State University
Ames, IA

Los Alamos National Laboratory
Los Alamos, NM

Michigan State University
East Lansing, MI

Nuonics, Inc.
Orlando, FL

Ohio State University
Colombus, OH

Prime Research, LC
Blacksburg, VA

Reaction Engineering, International
Salt Lake City, UT

REM Engineering Services, PLLC
Morgantown, WV

Sandia National Laboratories
Livermore, CA

Sensor Research and Development Corporation,
Orono, Maine

SRI International
Menlo Park, CA

University of Akron
Akron, OH

University of Florida
Gainsville, FL

University of Pittsburgh
Pittsburgh, PA

Virginia Polytechnic Institute and State University
Blacksburg, VA

Elements

Separation Technologies – Generate the fundamental knowledge necessary to increase the effectiveness of air separation and high pressure, high temperature hot gas cleanup and particulate removal processes.

Advanced Concepts and Systems Studies – Analytical, computational, or experimental studies intended to test novel concepts or evaluate promising power systems components, configurations, or integration issues.

Carbon Capture and Sequestration – Explore basic mechanisms which control the effectiveness of existing CO_2 sorbents/solvents, develop more effective solvents based on an improved understanding of chemistry and kinetics and investigate methods for improving the efficiency of scrubbing systems which can incorporate novel membranes. Explore the fundamental interactions between naturally occurring alkali-containing minerals (or other wastes) and CO_2 as they relate to above ground mineral carbonation and in situ carbonation in an effort to develop the mineral-interaction knowledge base necessary to forecast the near- and long-term performance of geologic storage concepts.

Instrumentation, Sensors, & Control – Develop instrumentation and sensors that are critical to the implementation and optimization of advanced fossil fuel-based power generation.

Energy Conversion Chemistry – Discern the rates and mechanisms that control gasification, advanced combustion, and emissions when converting coal and opportunity fuels to power. Results from these critical analyses provide designers of advanced fuel flexible power systems with the information necessary to efficiently minimize NO_x, SO_2, unburned carbon, air toxics, and particulate emissions.

Visualization, Design, and Integration – Develop the capability to utilize immersive, interactive, distributed visualization technology in the design of next-generation power plants. Implement the use of advanced, distributed Computer-Aided Design tools for virtual design groups. Develop system tools that will allow the integrated use of information technology in power plant design.

Mechanistic Model Development – Develop versatile, reliable models for the performance of power production processes that are based on the fundamental laws of science.

Benefits

Benefits of the CUS Program include the support of national research facilities and enhanced technology transfer through industrial participation, the education of highly skilled scientists and engineers needed for a competitive U.S. economy, the promotion of a diverse portfolio of fuels, and the creation of new jobs and investment opportunities.

Additional benefits contribute to economic gain. Work supported through this program expedites commercial availability of technologies, which assists in reducing initial investments. Another financial benefit of the CUS Program is that the fundamental nature of the work allows for developments that produce significant cost reductions when compared to competing technologies.

Specific activities within the Program continue to support the goals of efficiency and reliability improvements as well as better environmental performance of fuel-flexible power plants.